Specification Amendments:

Please amend the specification as indicated:

Please replace the Abstract with the following replacement Abstract.

A method and system are disclosed for high-resolution modeling of a well bore in a reservoir. An embodiment of the present ~~invention comprising~~ disclosure comprises the steps of constructing a first unstructured mesh~~,~~ having a plurality of n-dimensional simplices~~,~~ corresponding to a first modeled system (space), defining a surface bounding a second modeled space, identifying a subset of the plurality of n-dimensional simplices of the first mesh that are intersected by the surface, and modifying the subset of simplices so as to adapt the first mesh such that it comprises a second mesh and a third mesh, wherein the second mesh comprises a set of simplices located entirely interior to the surface and wherein the third mesh comprises another set of simplices located entirely exterior to said surface. ~~In this way, new elements are defined within the intersected elements such that one or more of the faces of the new elements are substantially coincident with said surface (that is, they lie approximately on the surface), and such that some of said new elements lie entirely within the volume defined by said surface, and other elements entirely outside of said volume. More specifically, for each element that is intersected by the surface, a set of points at which the faces, edges or vertices of the element are intersected by the surface is determined (if the element is only intersected at a single point, it need not be subdivided into two or more new elements). At each point of intersection, a new node is created (if the point of intersection is not a node) and two new elements that incorporate the new node are generated. This process is performed for each point of intersection to subdivide the intersected element into a number of new simplex elements, some of which comprise faces that lie substantially on the modeled surface.~~

Please replace the paragraph [0007] with the following replacement paragraph.

[0007] One way to reduce the cost associated with increasing the accuracy of a finite element model is to use an unstructured mesh, such as that disclosed in related U.S. Patent Application Publication No. 2002/0032550 entitled, "A METHOD FOR MODELING AN ARBITRARY WELL PATH IN A HYDROCARBON RESERVOIR USING ADAPTIVE MESHING," filed on Jun. 29, 2001 (the "Adaptive Meshing Application"), which is hereby fully incorporated by reference. In an unstructured mesh, the elements that comprise the mesh are not constrained to fit within a predetermined structural scheme. For example, the elements are not required to be selected from a finite set of pre-defined element shapes (e.g., hexahedral) or sizes. More particularly, it may be convenient to employ a mesh that comprises simplex elements that have no pre-defined constraints. The faces of the simplex elements can be oriented to follow the contours of a surface that is being modeled and may, therefore, achieve accuracy that is on par with a structured mesh having many more elements because the faces of the simplex elements need not be parallel to pre-determined planes. As a result, the unstructured mesh is simpler and can be solved faster and easier. The Adaptive Meshing Application discloses a method for defining the elements of an unstructured mesh such that a surface being modeled is essentially coincident with the faces of the elements in the mesh (or more particularly with some of the element faces), such that the surface can be accurately defined and irregular surfaces can be properly modeled.

Please replace paragraph [0045] with the following replacement paragraph.

[0045] Some embodiments of the method and system of this invention have as a first step the generation of a mesh to model a reservoir in which will be located a well bore. This first step of generating the reservoir mesh can be accomplished by any of a variety of known methods, and in particular, using the method described in the Adaptive Meshing Application referenced above. A description of this method of mesh generation is included below for ease of illustration. Another technique for generating a reservoir mesh in three dimensions is to extrude a two-dimensional mesh in the manner disclosed in related U.S. Patent ~~Application~~ No. 6,674,432 entitled, "METHOD AND SYSTEM FOR MODELING GEOLOGICAL STRUCTURES USING AN UNSTRUCTURED FOUR-DIMENSIONAL MESH" filed on Jun. 29, 2001 (the "Extruding Application"). This application is hereby fully incorporated by reference.

Please replace paragraph [0087] with the following replacement paragraph.

[0087] The algorithms of the method and system of the present invention can comprise computer executable software instructions and can be stored in memory such as RAM or ROM or any other fixed media, such as a hard drive. The computer executable software instructions of the embodiments of this invention can comprise a part of a larger set of computer-executable software instructions, but can act independently. The method and system of the present invention can be used with a computer graphical user interface, such as that disclosed in related U.S. Patent Application Publication No. 2002/0067373 entitled "SYSTEM AND METHOD FOR DEFINING AND DISPLAYING A RESERVOIR MODEL," filed on Jun. 29, 2001 (the "Work Flow Application"). Further, the inputs necessary for the algorithms of the present invention can be provided directly by a user or can themselves be computer executable software instructions received through a network, or input from some other medium such as a floppy disk or hard drive or other software program, such as an Excel spreadsheet.

Please replace paragraph [0088] with the following replacement paragraph.

[0088] One embodiment of the method and system of the present invention can explicitly generate a well bore (as discussed above) for the specific case of a vertical well. In such a case, flow around the well bore is essentially radial. In this situation, using the explicitly defined mesh for the well bore path provides a more suitable mesh for the radial flow condition in that the mesh itself is based on a radial physical configuration. The mesh is designed to more closely resemble the physical system being modeled. Further, the radial transform method of related U.S. Patent Application Publication no. 2002/0082813 entitled "METHOD AND SYSTEM FOR COORDINATE TRANSFORMATION TO MODEL RADIAL FLOW NEAR A SINGULARITY," filed on Jun. 29, 2001 (the "Radial Transformation Application") can be used within the well bore mesh area and surrounding areas to provide a better model solution. In this way, the geometry of the well bore mesh honors the actual physical well geometry while providing a means to more accurately solve the physical system for the properties in the near well region. For example, permeability and porosity near the well bore are important properties that can be measured in the field and then used to model how the property varies with distance and space in the area near the well bore. The mesh inside the well bore provides the ability to get better resolution and, in combination with the improved accuracy provided by the radial transformation disclosed in the Radial Transformation Application, provides for much better solutions in the near well regions then can be provided by prior art methods and systems. It is important to note that once a well bore moves away from the vertical, flow around the well bore becomes less radial. Beyond the near well area, ordinary meshing and ordinary solving techniques can be used.